

### **Remarks and Arguments**

Claims 1-48 have been presented for examination. Claims 1, 18, 25 and 32 have been amended.

Claims 1, 2, 4, 7, 16, 18, 20, 25, 27, 32, 33, 35, 38 and 47 have been rejected under 35 U.S.C. §102(e) as anticipated by U.S. Patent Publication No. 2003/0055972 (Fuller.) The examiner comments that the Fuller reference discloses all of the claimed limitations.

As previously discussed, the present invention is directed to a method and system for automatically maintaining a contracted level of service in a computer network. To this end, a plurality of service level parameters indicating the state of the system resources are measured and monitored in order to determine their values. Then, the service level parameter values are compared to predetermined service level thresholds in order to determine whether the contacted level of service is, in fact, being received. When the contracted service level is not being received, the system suggests a modification of at least one resource deployment or configuration that will bring the delivered service level into alignment with the contracted service level and, in one embodiment makes the suggested modification. Thus, it is the measured values of service level parameters that drive the modifications to the system.

The Fuller reference discloses a storage virtualization system in which a shared storage infrastructure is separated by a virtualization layer into logical storage areas with one customer being associated with each logical area. The shared storage infrastructure can also provide policy based storage management for each customer. In particular, as set forth in Fuller paragraphs 36 and 37, a management server that is part of the storage infrastructure can store service expectancies and policies outlined in a service level agreement. The management server can configure the storage network (SAN) in order to realize the attributes of a customer's SLA. The management server can further analyze information collected by the SAN network regarding the operation, performance or health of the network in order to determine whether the terms of the SLA associated with a customer are being met. However, what is not disclosed in Fuller is suggesting a modification of the network when the terms of the SLA are not being met. Instead, Fuller teaches notifying an administrator when the terms of the SLA

are not being met, for example by illumination warning icons. See, for example, Fuller, the last six lines of paragraph 37.

The examiner refers to Fuller paragraph 36, lines 18-23, as disclosing modification of the network when the terms of an SLA are not being met. This section of Fuller indicates that the system can configure the network based on the customer's SLA so that the attributes of the SLA can be met. It refers to the initial configuration of the network, not to ongoing monitoring during network operation. This is clear because the next paragraph (37) describes, in detail, the action taken when the network fails to meet the SLA during operation. Thus, Fuller does not disclose that the management server detect when the customer's SLA is not being met and then suggest a resource modification to correct the problem based on measured values.

The examiner further notes that paragraph 61 of Fuller discloses that when a customer alters its SLA the system can automatically modify the system to meet the new SLA. However, as the examiner notes, this section of Fuller recites that the network is modified based on the customer's need and is driven by customer actions, not by measurements that indicate that the current SLA is not being met. This is an "open-loop" system, not the "closed loop system" recited in the claims.

The claims particularly point out this difference. For example, claim 1 recites, in lines 5-16, "...after an initial resource configuration has been established and continually during the operation of the system, measuring and monitoring a plurality of service level parameter values indicating a state of the resources in the system; determining whether the measured service level parameter values satisfy predetermined service level thresholds; and determining a corrective modification of one at least one resource deployment or configuration based on the measured service level parameter values when the value for the service level parameter for the resource does not satisfy the predetermined service level thresholds in order to satisfy the predetermined service level thresholds." As set forth above, Fuller teaches simply notifying an administrator in this situation and does not teach determining a corrective modification based on measurements. Therefore, claim 1 patentably distinguishes over the cited Fuller reference. Claim 18 has been amended to contain similar limitations in lines 5-17 and claim 25 contains similar limitations in lines 9-22. Finally, claim 32

contains similar limitations in lines 6-17. Therefore, these claims also patentably distinguish over the cited Fuller reference.

Claims 2, 4, 7 and 16 are dependent, either directly or indirectly, on claim 1 and incorporate the limitations thereof. Therefore, they distinguish over the cited reference in the same manner as claim 1.

Claim 20 is dependent on claim 18 and incorporates the limitations thereof. Therefore, it distinguishes over the cited reference in the same manner as claim 18.

Claim 27 is dependent on claim 25 and incorporates the limitations thereof. Therefore, it distinguishes over the cited reference in the same manner as claim 25.

Claims 33, 35, 38 and 47 are dependent, either directly or indirectly, on claim 32 and incorporate the limitations thereof. Therefore, they distinguish over the cited reference in the same manner as claim 32.

Claims 3, 19, 26 and 34 have been rejected under 35 U.S.C. §103(a) as obvious over Fuller in view of U.S. Patent Publication No. 2002/0069377 (Mabuchi) and U.S. Patent No. 6,381, 637 (Kamada) and further in view of U.S. Patent No. 5,504,858 (Ellis.) The examiner comments that Fuller discloses all of the claimed limitations with the exception that it does not explicitly disclose that the service level parameters include downtime, unavailability to applications and hosts, throughput and I/O transaction rate. However, the examiner asserts that Mabuchi discloses monitoring the amount of time that a storage device is defective, Kamada discloses unavailability and Ellis discloses monitoring of request and data rates. The examiner concludes that it would have been obvious to combine Fuller, Mabuchi, Kamada and Ellis because they are all in the same field.

The Mabuchi reference discloses a disk array controller in which access timeout values are adjusted depending on whether all disks in the array are normal or some are defective. The Kamada reference discloses a mechanism for automatically tracing links on an Internet web page based on predetermined rules and parameters. The Ellis reference discloses a RAID storage system in which parity metadata is stored on each disk of the RAID array. The parity metadata identifies invalid parity blocks and prevents the generation of undetectable corrupt data. While Mabuchi, Kamada and Ellis disclose various aspects of system performance monitoring, none of the references is directed to

the problem of service level monitoring and automatic reconfiguration of a system to achieve a contracted level. Thus, their combination with Fuller cannot teach or suggest a corrective modification of a resource deployment or configuration when a contracted level of service is not met, an operation that, as discussed above, Fuller does not teach. Thus, the combination of Fuller with Mabuchi, Kamada and Ellis does not teach or suggest the limitations recited in the independent claims 1, 18, 25 and 32. Since claims 3, 19, 26 and 34 are dependent on claims 1, 18, 25 and 32, respectively, they distinguish over the cited combination of references in the same manner as the independent claims.

Claims 5, 6, 21, 28, 36 and 37 have been rejected under 35 U.S.C. §103(a) as obvious over Fuller in view of Ellis. The examiner comments that Fuller discloses all of the claimed limitations except that it does not disclose determining a time period during which the service level available to a customer does not satisfy the contracted service level parameters. However, the examiner asserts that Ellis discloses monitoring a data rate in a read/write operation and that it would have been obvious to combine Fuller and Ellis because both references are related to storage systems.

As discussed above Ellis is concerned with a RAID storage system and preventing the generation of undetectable corrupt data. Although Ellis may disclose various aspects of system performance monitoring, it is not directed to the problem of service level monitoring and automatic reconfiguration of a system to achieve a contracted level. Thus, its combination with Fuller cannot remedy the omissions of Fuller as discussed above. Thus, the combination of Fuller with Ellis does not teach or suggest the limitations recited in the independent claims 1, 18, 25 and 32. Since claims 5, 6, 21, 28, 36 and 37 are dependent on claims 1, 18, 25 and 32, respectively, they distinguish over the cited combination of references in the same manner as the independent claims.

Claims 8, 10, 12, 17, 22, 23, 29, 30, 39, 41, 43 and 48 have been rejected under 35 U.S.C. §103(a) as obvious over Fuller in view of U.S. Patent Publication No. 2003/0074599 (Golasky.) The examiner comments that Fuller discloses all of the claimed limitations except that it does not disclose determining which resource caused the service level to not meet the contracted level, determining if another resource of that

type is available and, if so, allocating another resource to service the customer. However, the examiner asserts that Golasky discloses a system in which the failure of a resource causes another backup resource to be utilized and that it would have been obvious to combine Fuller and Golasky because both reference are related to storage systems.

The Golasky reference discloses a data backup system in which a failure of a logical unit in a storage device causes a backup agent to locate the backup copy of the data transfer the data to a spare logical unit in the storage device and remap the spare logical unit. The combination of Fuller and Golasky cannot teach or suggest the limitations recited in the claims because, as admitted by the examiner, Fuller does not teach determining if an alternate resource is available when a resource that caused the failure to meet contracted service level is identified. Golasky also does not disclose this step since Golasky is a backup system and a backup copy is always available. The examiner points to Golasky, paragraph 25, as disclosing this limitation. However, at the suggested paragraph, Golasky discloses that the recited agent locates the spare resource and configures it. Golasky does disclose several ways to locate the spare including using an unassigned logical unit and rebooting to locate the spare. However, since a spare will always be available in a backup system, Golasky does not disclose determining if such a spare is available, because in Golasky a spare unit will always be found – otherwise the backup system would be inoperative.

Thus, neither reference teaches or suggests “...determining whether any additional instances of the determined at least one resource that contributes to the failure of the service level parameter is available...” as recited in claim 8. Claims 10, 12 depend on claim 8 and incorporate the limitations thereof. Therefore, they distinguish over the cited combination of references in the same manner as claim 8. Claims 22, 29 and 39 contain limitations that parallel those in claim 8 and distinguish over the cited combination of references in the same manner as claim 8. Claims 23, 30, and 41 depend on claims 22, 29 and 39, respectively, and incorporate the limitations thereof. Therefore, they distinguish over the cited combination of references in the same manner as their respective parent claims.

In addition, Golasky is not directed to the problem of service level monitoring and automatic reconfiguration of a system to achieve a contracted level. Thus, its combination with Fuller cannot remedy the omissions of Fuller as discussed above. Thus, the combination of Fuller with Golasky does not teach or suggest the limitations recited in the independent claims 1, 18, 25 and 32. Since claims 8, 10, 12, 17, 22, 23, 29, 30, 39, 41 and 43 are dependent on claims 1, 18, 25 and 32, respectively, they distinguish over the cited combination of references in the same manner as the independent claims.

Claims 9 and 40 have been rejected under 35 U.S.C. §103(a) as obvious over Fuller in view of Golasky and further in view of Ellis. The examiner comments that Fuller and Golasky disclose all of the claimed limitations except that they do not disclose analyzing the resource deployment by using a bottleneck analysis. However, the examiner asserts that Ellis discloses that accessing a storage device can cause a bottleneck and that it would have been obvious to combine Fuller, Golasky and Ellis because these three references are related to storage systems. Fuller, Golasky and Ellis have been discussed above. The examiner claims that although Ellis does not explicitly mention a bottleneck analysis, it does mention the use of RAID, spreading of data and load balancing which can be considered a bottleneck analysis. Applicants agree that load balancing could be done using a bottleneck analysis, but the fact that it could be done in this manner does not amount to a teaching an automatic resource deployment using a bottleneck analysis in order to arrive at a modification of an existing network as recited in claims 9 and 8 (on which claim 9 depends). Since the examiner admits that Fuller and Golasky also do not teach this limitation, the claims patentably distinguish over this combination of references. Further, although a bottleneck analysis may be well-known in certain contexts, Applicants disagree that any of the references teach this type of analysis in the context in which it is used and as recited in the claims.

In addition, neither Golasky nor Ellis is directed to the problem of service level monitoring and automatic reconfiguration of a system to achieve a contracted level. Thus, their combination with Fuller cannot remedy the omissions of Fuller as discussed above. Thus, the combination of Fuller, Golasky and Ellis does not teach or suggest the limitations recited in the independent claims 1 and 32. Since claims 9 and 40 are

dependent on claims 1 and 32, respectively, they distinguish over the cited combination of references in the same manner as the independent claims.

Claims 11 and 42 have been rejected under 35 U.S.C. §103(a) as obvious over Fuller in view of Golasky and further in view of Ellis and U.S. Patent No. 6,301,605 (Napolitano) and U.S. Patent No. 5,956,750 (Yamamoto.) The examiner comments that Fuller and Golasky disclose all of the claimed limitations except that they do not expressly disclose specific access characteristics including read/write ratio, input/output size, and percentage of sequential or random accesses. However, the examiner asserts that Ellis discloses the measurement of read/write ratios, Yamamoto discloses measuring the percentage of sequential or random accesses and Napolitano discloses that file size can be monitored in I/O transactions.

Napolitano discloses a distributed file system in which the input/output subsystem for the file system is located entirely on an adapter coupled to a host computer. Thus, the distributed file system consists of a client file system executing on the host computer and a server file system executing on the adapter. Yamamoto discloses a storage controller in which logical drives are reallocated to physical devices depending on the disk access frequency for load balancing purposes.

Since neither Ellis, Napolitano or Yamamoto is directed to the problem of service level monitoring and automatic reconfiguration of a system to achieve a contracted level, their combination with Fuller and Golasky cannot remedy the omissions of Fuller as discussed above. Thus, the combination of Fuller, Golasky, Ellis, Napolitano and Yamamoto does not teach or suggest the limitations recited in the independent claims 1 and 32. Since claims 11 and 42 are dependent on claims 1 and 32, respectively, they distinguish over the cited combination of references in the same manner as the independent claims.

Claims 13, 24, 31 and 44 have been rejected under 35 U.S.C. §103(a) as obvious over Fuller in view of U.S. Patent No. 6,006,251 (Toyouchi.) The examiner comments that Fuller discloses all of the claimed limitations except that it does not disclose that applications in the system can be assigned a priority and that changing the deployment of resources to meet contracted service levels can include changing the priority of applications. However, the examiner asserts that the Toyouchi reference

discloses dividing information requests into priority groups and changing priorities based on a relationship to a parameter.

The Toyouchi reference discloses a client server system in which a “service computer” is interposed between the existing clients and servers. The service computer receives service requests from the clients and directs the requests to the proper servers, thereby increasing the efficiency of the overall system.

The Toyouchi reference is not directed to the problem of service level monitoring and automatic reconfiguration of a system to achieve a contracted level and, thus, its combination with Fuller cannot remedy the omissions of Fuller as discussed above. Thus, the combination of Fuller and Toyouchi does not teach or suggest the limitations recited in the independent claims 1, 25 and 32. Since claims 13, 24, 31 and 44 are dependent on claims 1, 25 and 32, respectively, they distinguish over the cited combination of references in the same manner as the independent claims.

Claims 14 and 45 have been rejected under 35 U.S.C. §103(a) as obvious over Fuller in view of Toyouchi and further in view of Golasky. The examiner comments that Fuller and Toyouchi disclose all of the claimed limitations with the exception that they do not disclose analyzing a resource deployment in order to determine which resource caused the service level to not meet the contracted level, determining if another resource of that type is available and, if so, allocating another resource to service the customer. However, the examiner asserts that Golasky discloses a system in which the failure of a resource causes another backup resource to be utilized and that it would have been obvious to combine Fuller, Toyouchi and Golasky because all of these references are related to storage systems.

As discussed above, Golasky does not disclose determining if another resource of that type is available, since Golasky is a backup system and a backup copy is always available. Thus, none of the references teach or suggest “...determining whether any additional instances of the determined at least one resource that contributes to the failure of the service level parameter is available...” as recited in claims 14 and 45. Therefore these claims distinguish over the cited combination of references.

In addition, also as mentioned above, Golasky is not directed to the problem of service level monitoring and automatic reconfiguration of a system to achieve a



contracted level. Thus, its combination with Fuller and Toyouchi cannot remedy the omissions of Fuller as discussed above. Thus, the combination of Fuller, Toyouchi and Golasky does not teach or suggest the limitations recited in the independent claims 1 and 32. Since claims 14 and 45 are dependent on claims 1 and 32, respectively, they distinguish over the cited combination of references in the same manner as the independent claims.

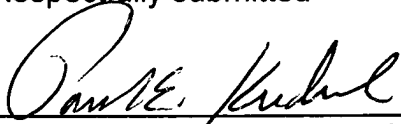
Claims 15 and 46 have been rejected under 35 U.S.C. §103(a) as obvious over Fuller in view of U.S. Patent Publication No. 2001/0044907 (Yoshimoto.) The examiner comments that Fuller discloses all of the claimed limitations with the exception that they do not disclose that a service level parameter that could cause the service level to fall below the contacted value could be an input/output throughput parameter. However, the examiner asserts that Yoshimoto discloses a system that monitors input/output throughput and that it would have been obvious to combine Fuller and Yoshimoto because all of these references are related to storage systems.

The Yoshimoto reference discloses a computer system that has a power saving mode. The patent is specifically directed to determining the period of periodic disk accesses so that the system can be placed in power saving mode during the time between accesses. As with the other cited prior art references it has nothing directly to do with the problem of service level monitoring and automatic reconfiguration of a system to achieve a contracted level. Thus, its combination with Fuller cannot remedy the omissions of Fuller as discussed above. Thus, the combination of Fuller and Yoshimoto does not teach or suggest the limitations recited in the independent claims 1 and 32. Since claims 15 and 46 are dependent on claims 1 and 32, respectively, they distinguish over the cited combination of references in the same manner as the independent claims.

In light of the forgoing amendments and remarks, this application is now believed in condition for allowance and a notice of allowance is earnestly solicited. If the

examiner has any further questions regarding this amendment, he is invited to call applicants' attorney at the number listed below. The examiner is hereby authorized to charge any fees or direct any payment under 37 C.F.R. §§1.17, 1.16 to Deposit Account number 02-3038.

Respectfully submitted



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